# TUT 4: Diamond-Growth, characterization, electronics and applications (joint session KFM/TUT)

This tutorial is dedicated to growth mechanisms of diamond (single and polycrystalline) and corresponding physical properties, used for electronic applications. Process technologies and production of diamond devices tailored for special technical applications will be discussed. Applications for diamond in high power and high frequency components will be presented.

Organized by Theo Scherer (KIT)

Time: Sunday 16:00–18:15 Location: H10

**Tutorial** TUT 4.1 Sun 16:00 H10

**Diamond′s bright future in electronics and quantum technology** — •Matthias Schreck — Institut für Physik, Universität Augsburg

The present talk gives first a general introduction into diamond growth by chemical vapor deposition (CVD). Then, it describes the different approaches and the crucial steps for the realization of single crystal diamond on wafer scale. The focus will be on the heteroepitaxial multilayer system Dia/Ir/YSZ/Si which is currently the most advanced as demonstrated by the successful synthesis of a monocrystalline disc with a diameter of 92 mm and a mass of 155 ct.
The second part addresses current and potential future applications. Cutting tools for high precision machining, scalpels for eye surgery as well as visible/infrared optical elements based on CVD grown single crystals are already available on the market. Detectors for high energy ionizing radiation required at large particle physics research facilities like GSI or CERN are under development. In the field of high power electronics, diamond should outperform all other wide bandgap materials according to its intrinsic material parameters, but highly competitive devices that may be grown on the new wafers are still to be demonstrated. Finally, emerging quantum technologies based on color centers hosted in the diamond crystal lattice open a fascinating new field.

**Tutorial** TUT 4.2 Sun 16:45 H10

**Microwave CVD of Diamond** — •Volker Buck — Uni. Duisburg-Essen

The contribution starts with historic remarcs concerning microwave CVD of Diamond. Then basic physics of microwave plasmas are presented to explain the concepts of usual microwave reactors. After this, standard process parameters for deposition of microcrystalline diamond films are given. An overview of problems related with epitaxy leads to actual research and within this context also the state of the art of doping is discussed. Some general aspects of nanotechnology then leads to ultrananocrystalline diamond films (UNCD) and color centers. An outlook concludes the contribution.

**Tutorial** TUT 4.3 Sun 17:30 H10

**High power and high frequency applications of diamond** — •Dirk Strauss — KIT Karlsruhe, Deutschland

Content of this tutorial is the presentation of basic properties of polycrystalline as well as single crystalline CVD diamond in high frequency (GHz-THz) and high power (MW) applications with extreme low microwave losses. Starting with growth conditions of diamond, optimization of dielectric and thermal properties up to implementation in diamond window assembly structures for multi-frequency applications (step tunable and Brewster windows) the complete development process and the state of the art today will be presented. Main applications of this field are heating and diagnostic systems in nuclear fusion reactors, accelerator and laser devices, where such windows can be implemented with outstanding physical properties.